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## MANABAS COAST

### Baseline Assessment for all pilots

An initial activity of WP2 is a description and baseline assessment of each study pilot that will be used as the baseline to assess progress during the project and can aid in the future cooperation between the study pilots. The assessment also serves to establish the status of mainstreaming of NbS into the pilots. The assessment survey is divided up into three parts: 1) Description of the pilots, 2) Questions concerning how the enablers are currently addressed in the pilots, and 3) Brief questions about the MANABAS framework (inspired by ISBAM).

### Part 1: Pilot description

*Our aim is to mainstream nature-based solutions on the different coasts of northwest Europe. Therefore we need a description of the coastal system. This is divided into two sections: A) description of the coastal (natural) system of the pilot, and B) description of the governance system.*

**Name of pilot:**

**Salt marshes main land Dutch Wadden Sea**

**Location of pilot:**

LLC = 52.90 ; 4.74 ; URC = 53.55 7.17 (lat-lon)

The pilot applies to the whole mainland coast with and without salt marshes along the Dutch Wadden Sea.

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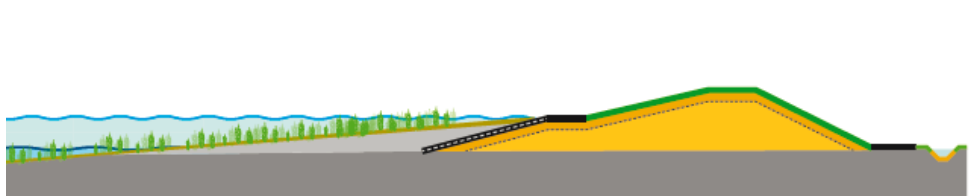
*Map: overview of salt marsh areas in the Dutch part of the Wadden Sea*

### **Pilot aims/objective:**

In this pilot we aim to investigate the (upscaling) possibilities for applying dikes with natural or semi-natural salt marsh areas for flood safety and ecology. We want to describe to potential benefits and disadvantages of this BwN solution for flood safety, ecology and other functions of the salt marsh areas, such as recreation, agriculture, tourism, landscape and CO<sub>2</sub> capture. Besides a direct benefit for flood safety, the natural foreshores may also provide clay as sustainable building material for dikes.

### **Which nature-based solutions will you be working with in MANABAS?**

*We will work on dikes with (natural) foreshores.*



*Figure: principle sketch of a dike with a (natural) shallow foreshore or salt marsh.*

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*Photo: dike with salt marshes (Courtesy: beeldbank Rijkswaterstaat)*

### A. Description of the coastal system

*Please briefly describe those areas that are relevant for your pilot:*

1. The landscape including geology, morphology, and biology.  
On the sea side of the pilot area, the landscape consist of the Wadden Sea. An unique natural area consisting of gullies and tidal flats. The Wadden Sea is characterized by natural dynamics which are largely undisturbed. However, at the boundaries, human activities such as dike building and closure dams have significantly influenced the hydrodynamics and morphological development of the area. On the land side the area is characterized by (intense) agricultural land use. There is mixed use of grassland and crops. A major (and profitable) activity is growing seed potatoes. Due to specific circumstances the area directly behind the dikes is especially suitable.
2. The hydrodynamic forcing from tide, water level, wind and waves. If possible, include some statistical values  
The main forcing in the Wadden Sea consists of the natural tides, currents and

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wave action. The average tidal range varies from the west (Den Helder) to the east (Ems-dollard estuary) from about between 1,5 meters up to 3 meters. The wave climate is very moderate as the Wadden Sea is sheltered by the barrier islands, with average wave heights well below 1 meter. However, during severe storms wave height can be above 2 meters. Currents vary a lot, but can be significant in the (deep) gullies, up to 2-3 m/s.

3. Which current NBS solutions are already present (it can be a non-engineered original landscape)

This depends a little on the definition. In the Wadden Sea salt marshes are already present, providing sheltering for the dike system. Also, sand nourishments are performed along the coast of the Wadden Sea islands. An overview report is available: [Overzicht adaptatie-gerelateerde projecten Waddenkust verschenen - Waddenzee](#). Most of the present situations with dikes and foreshores have not been specifically developed as NBS for flood protection. Salt marshes were developed as part of land reclamation strategies.

4. Describe how study pilot is monitored.

Primary focus of the pilot is on a desk study, not on physical measures. Therefore there is no direct need for (physical) monitoring. However, use can be made of available basic monitoring by a.o. Rijkswaterstaat. This consists of bed levels, hydrodynamics and ecological monitoring. Several managing organisations, such as Fryske Gea, Groninger Landschap (and many more) also perform measurements (mainly ecology, such as bird counting)

5. Describe the sediment dynamics: Macro or micro sediment budget, conceptually or detailed volumetric monitoring. Include any dredging

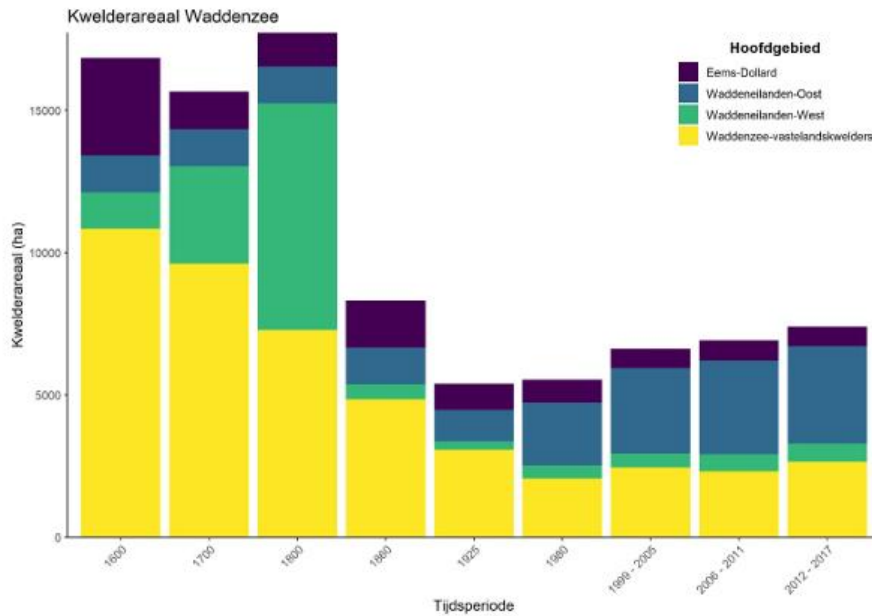
The salt marshes and foreshores are dynamic. During severe winter conditions (cliff) erosion occurs, but also fine sediments are delivered to the higher areas. In more calm (summer) conditions salt marshes can restore, but also compaction occurs, decreasing the bed level. Based on long-term measurements of bed levels insight can be derived in the sediment budgets. Dredging is not of direct relevance here.

6. Long term trends. These could be chronic erosion, long-term subsidence or trends in mean sea level.

This differs strongly across the region. Some salt marshes are degrading, both in height and in size. At the same time other areas are increasing in size and height. For the purpose of the pilot, insights in the long term developments are sufficient, being insight in the average bed level development and in- or decrease of the area.

Are salt marsh areas growing, eroding or stable? In the pilot area multiple areas are present, with varying trends. On average the total area of salt marshes is slightly increasing in the Dutch Wadden sea (see below, taken from “Lange-termijnontwikkeling van kwelders in de Waddenzee, Wot-technical report 182, K.Elschot, et.al.)

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7. Describe the current coastal protection being used in the study pilot.  
Along the mainland coast of the Wadden Sea a closed dike system is present to protect the hinterland from flooding. The dikes have relatively high safety standards. Several dike strengthening campaigns are ongoing. Further small rock dams and brushwood fences are used to protect the salt marshes against erosion and to stimulate sediment catching.
8. Describe the current risk of flooding and erosion.  
The risk of flooding of the hinterland is very low. The dutch safety standards are relatively high compared to other countries. The maximum allowed risk of drowning due to flooding (behind the primary dike system) equals 1/100.000 per year. The dike sections along the Wadden Sea have a maximum allowed chance of failing between 1/3000 and 1/10.000 per year.
9. Which human activities impact your coastal system?  
The Wadden Sea is intensively used by humans. Many activities take place ranging from harbours, recreation, fisheries, mining, transport. Also activities in the hinterland are relevant, influencing the fresh water run off and space for birds and animals to feed and rest.  
Most impact on the Wadden sea morphological development is the broad range of coastal protection works, such as dikes, closure dams and smaller protection works that fixated the boundaries of the morphological system, which also influences the development of foreshore and salt marshes. Looking at the salt marsh areas themselves, human influence is large. The salt marshes are managed quite intensively, mainly aiming at certain ecological goals. Several salt marshes are also being used for agriculture, mainly grazing of cattle.
10. Describe important culture and historical aspects in the study pilot





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The mainland salt marsh areas in the Wadden sea are mostly “unnatural”. Although they are important ecological areas nowadays, their existence is largely thanks to the former land reclamation strategies and the brushwood fencing works that were constructed to stimulate salt marsh growth and protect them against erosion. The traditional land use of the salt marshes was agriculture, this is a cultural / historical factor that is still of influence how people consider the salt marshes.

### B. Description of the governance context

*Please briefly describe those areas that are relevant for your pilot:*

11. Who are the landowners of the land?  
The Wadden Sea is owned by the State. The salt marsh areas are privately owned, State owned or owned by NGO's. The dike system is owned and managed by the Waterboards. The land behind the dikes is largely privately owned.
12. What are the main land uses in the pilot area (ie agriculture, nature reserve, infrastructure),  
The salt marsh areas are mostly in use as nature reserves. There is co-use by recreation and agriculture. The agricultural use, grazing, is mostly aimed at reaching specific ecological goals. The hinterland is mainly agricultural use.
13. What are the current laws and regulations that govern the use of nature-based solutions in the pilot (i.e Natura 2000, planning)?  
The main laws of relevance are the EU water framework directive, EU Habitats Directive, the EU Birds Directive, the dutch Waterwet (water) and the dutch Structuurvisie Waddenzee (spatial). Furthermore the “Agenda voor het Waddengebied 2050” (joint policy document of national and regional governments) sets the goals for 2050. On the local level, municipalities have to have “omgevingsvisies” and “bestemmingsplannen” (based on the so call WRO (law spatial planning). By 1-1-2024 the new “Omgevingswet” (law for the physical environment) will replace both the WRO and the Waterwet.
14. What is the current status of using nature-based solutions in your pilot area (ie to what extent are they mainstreamed into existing policy?)  
Dike systems with salt marsh areas are already present. However, these are all existing situations and not created as BwN solutions. Although many policies aim at applying BwN solutions, the present situation is not. The pilot aims to map the opportunities and required conditions for mainstreaming, in which both present situation and development of new salt marsh areas are considered.
15. What are the current goal conflicts (ie protecting cultural vs natural areas, or protecting private land vs municipal-owned land, or agricultural uses vs nature preservation?) How are these dealt with?  
The main challenge is to develop an integral approach towards management of the salt marsh areas. In the present situation management of the salt marshes is

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optimized for ecological values. Water boards are interested in optimizing management of the flood defense system by including salt marshes in the protection system. However, managing salt marshes as part of flood protection leads to different demands, e.g. on long term stability. This may conflict with the goals for nature conservation. For instance, for ecological reasons in some cases more dynamics are desired. This however leads to more uncertainty for the effect on the dike as allowing dynamics may also lead to decline. Salt marshes need to have a certain elevation to significantly benefit the dike system, but higher elevations are not always beneficial for the ecological quality. Amongst others due to the fact that flooding frequencies decrease. Water boards also need more space to improve dikes, and consider using space in the Wadden Sea. However, this leads to loss of protected nature. More sustainable dike solutions, such as BwN solutions, generally need more space leading to a larger spatial conflict. The challenge is to find a balanced strategy that serves both flood safety and ecology of the Wadden Sea.

16. How are the stakeholders identified and involved  
Rijkswaterstaat is overall responsible for salt marsh management with respect to the N2000 goals. From this, the stakeholders are well known, and regular talks take place. Main stakeholders are the water boards, several landowners, users of the areas (agriculture) and managing organizations of the salt marsh areas (NGO's / Nature organisations). In the pilot we will mainly cooperate with the Waterboards to investigate their needs.
17. Briefly describe the socio-economic development in the area.  
In the pilot area in general no new (large) developments are planned as the area is designated as Natura2000 area. In the hinterland no large changes are expected in the agricultural use, although the sector will face more challenges with drought and siltation. The farming sector is characterized by upscaling (fewer but larger companies). In less developed parts of the coastal area livability is under pressure.
18. What do you experience as the main barriers to mainstreaming NbS in your pilot?  
The main challenge is to get the dike- and salt marsh managing organizations to cooperate and develop integral plans for the salt marsh areas in which both the goals for flood safety and ecology are elaborated. This gives clarity to which extent the BwN solution "dike with salt marsh" can be applied and under which conditions and restrictions. Present day salt marsh management plans are generally aimed at nature goals. The challenge we see is to work towards an integral vision for the future situation in which also secondary goals such as CO2 storage and recreational use is considered.

### C. Implementation scheme

*Please describe your timeline for implementing NbS during MANABAS and beyond (i.e. starting point, estimated finalization, monitoring period)*

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We do not aim at physically implementing NbS in the pilot. We will consider ongoing initiatives such as the Green Dollard dike (dike with local clay) (partly realised, upscaling planned coming years), Lauwersoog-Vierhuizen (dike strengthening in execution, including new salt marsh development) and Koehoal-Lauwersmeer (planning phase, realization between 2024 and 2030). This means that several relevant projects are ongoing during the Manabas time frame, from which we can extrapolate information, and possibly help in upscaling NbS.

### Part 2: Enabler Assessment

*Please consider the barriers identified in Part 1B (question #18). The enablers below are meant to be ways to overcome these barriers. However, these enablers are not set in stone and will be further developed, augmented and /or changed during the MANABAS Coast project. There may be other enablers that are more important in certain pilots or for mainstreaming NBS. We will explore these during our project. In this assessment we want to get an initial idea of how these proposed enablers by EcoShape play out in your pilot and for mainstreaming NBS on a large scale.*



#### **Enabler 1: Technology and system knowledge**

- Which types of technology or systems knowledge are important in your pilot? (i.e. Sediment cell, salt marsh protection, salt marsh dynamics, sand nourishment, enhanced dune development)
  - Long term morphological development





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- Ecosystem functioning
  - Dike loads and failure mechanisms
  - Salt marsh management, including ecological knowledge and morphological knowledge)
- Are there any knowledge and technology gaps in your pilot that need to be addressed? Please briefly describe.
    - In the basis we assume that sufficient knowledge is available to implement this NbS. Of course there are always uncertainties, such as climate developments, sea level, etc.. But one of the challenges is to overcome uncertainties by clearer arrangements on responsibilities and risks. An potential example of such arrangements: if the salt marsh will erode too much, Rijkswaterstaat (??) will take measures to prevent further decline.
    - In the project Living dikes (also involved in Manabas) some of the knowledge gaps are further investigated, for instance the resistance of salt marsh vegetation against erosion.

### **Enabler 2: Multistakeholder approach**

- Who are the main stakeholders in your pilot?  
The water boards
- How will you engage your stakeholders in the project?  
We aim to work together with the Water boards on developing a future vision on salt marsh management in the Wadden sea and identify the needs of the water boards. This will be done by interviews, workshops and other forms of cooperation.

### **Enabler 3: Management, monitoring, and maintenance**

- What routines does your pilot have in place for management, monitoring and maintenance of the NbS?  
Since we do not aim for a physical pilot location, monitoring and maintenance is not (directly) applicable. Management is however a topic when we consider future management of a salt marsh area aiming at (balancing) multiple goals. This is a new situation, so the options for management (who is responsible for what?) need to be discussed as part of this pilot study.
- How do you measure the success of your pilot? Do you have any indicators for successful mainstreaming of NbS?  
The pilot is considered successful if we are able to deliver a set of concrete recommendations for future dike and salt marsh management. Besides management



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we also aim at developing a set of required boundary conditions where and when salt marshes can (not) be incorporated (or developed) for flood safety.

### **Enabler 4: Institutional embedding**

- How do current institutional arrangements already facilitate mainstreaming of NbS? Please describe and mention the key institutions

The Deltaprogramma Waddengebied – this is a cooperation between national and regional governments aiming at safeguarding flood safety and fresh water supply in the future - has established a preferential strategy (already in 2014) to strengthen dikes in such a way that the area is also improved. Also in the Trilateral Waddensea Cooperation, Nature based solutions are promoted. However, none of the arrangements are (legally) binding. When strengthening dikes, water boards of course need to comply to the law. However, the restrictions in the sectoral laws do not always enable / facilitate integral solutions. This is one of the points we aim to elaborate (see also the letter of the Policy reflection group on nature laws)

- How committed is your organization to mainstreaming NbS within MANABAS Coast and after the project ends?  
Rijkswaterstaat is not responsible for dike management in the study area. Since we are talking about NbS flood defense's in this pilot, the true upscaling is up to the Water boards. We observe that all waterboards are willing and committed to look at NbS when strengthening dikes.

Rijkswaterstaat in principle encourages integral and sustainable solutions, including BwN for flood safety. However, we do look carefully at the ecology of the Wadden Sea as this is our primary responsibility. Applying NbS may certainly not lead to decline, and should preferably lead to (significant) improvement of the ecosystem. One of the dilemmas is that NbS tend to require space of the Wadden Sea (building IN nature), whilst their ecological benefit on scale of the Wadden Sea ecosystem is not always clear.

### **Enabler 5: Business Case**

- Do you face problems with funding in your pilot? Please briefly describe, including the general sources of funding.  
This is not an issue at the moment. The challenge along the Dutch Wadden Sea is at the moment to develop integral solutions for the coastal zone which all involved parties agree on.



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- How will your pilot and/or continued mainstreaming be funded after the MAN-ABAS Coast project?  
In the Netherlands a national fund is available for dike strengthening ([www.hoogwaterbeschermingsprogramma.nl](http://www.hoogwaterbeschermingsprogramma.nl)). The fund also allows (and supports) BwN solutions. Furthermore additional funds are available to finance nature development and/or other developments (e.g. Programmatishce aanpak grote wateren, Waddenfonds, Investeringskader Wadden).

### **Enabler 6: Capacity building**

- What types of capacity building would your pilot need in order to facilitate mainstreaming of NbS?  
Our main focus will be on creating an enabling environment (systemic capacity). The individual organization generally don't lack capacity to work and implement NbS. Mainly the collaboration needs to be strengthened in order to overcome other challenges (e.g. legal and long-term agreements)

### **Enabler ranking**

To what extent are the above enablers important for mainstreaming NbS in your region?  
Please rank (1 is least important, 10 is most important)

#### **Enabler 1: Technology and system knowledge**

8

#### **Enabler 2: Multistakeholder approach**

7

#### **Enabler 3: Management, monitoring and maintenance**



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**Enabler 4: Institutional Capacity -> embedding**

7

**Enabler 5: Business case**

3

**Enabler 6: Capacity Building**

8

### **Suggestion for additional enablers**

Are there any aspects of mainstreaming enablers from your pilot that you can already suggest? If so please briefly state these:

I have no suggestion for the time being.

### Part 3 MANABAS mainstreaming framework (inspired by earlier work e.g. ISBAM)

*Within MANABAS Coast we are working on a framework that helps in mainstreaming NBS. To develop this framework, we need information on the pilots as well as the ambitions and goals of the different organization involved. We build on work already done in the past such as the ISBAM approach, which was developed in the Interreg BwN project (see also the brochure in the appendix for a further explanation or online). Just as the enablers, the MANABAS mainstreaming framework is still a work in progress.*

*As a starting point for the MANABAS framework, 3 leading principles from ISBAM are evaluated. We would like to know if these principles can also be applied across the entire northwest Europe coasts and how they can be improved. .*

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*Three leading principles have been identified that are deemed important to enable mainstreaming of NBS:*

MANABAS Coast principle 1: "Act at a landscape (system) scale, including both the natural and socio-economic system/context"

- Do you identify with this principle?  
Yes, this is relevant/applicable in our case. The application of the considered BwN solution (dike with foreshore / ecological dikes / wide green dikes) require more space than traditional dikes. We therefore need to integrate goals for the hinterland and Wadden Sea to find solutions. This means working at the scale of the landscape, including the people living/working there.
- Is this principle applied (to a certain degree) within your pilot? And within your organization? If yes, how?  
Not directly within our pilot, but within Rijkswaterstaat. In recent years, we have intensified our cooperation with water boards and municipalities in several dike strengthening projects. This is done by forming joint teams that work together from different perspectives (flood safety, ecology, regional development). Within these projects explicit attention is given to the goals and interest of the people living in the project area. E.g. by organizing sessions to collect wishes and concerns.
- In managing your assets, how are the system-wide effects and benefits taken into account?  
Rijkswaterstaat generally works with an approach where we consider managing the surrounding of our assets as a separate role. Our teams consist of a project manager, a technical manager, a contract manager, a project controller and a surrounding manager. The latter is responsible to involve all relevant stakeholders and collect their wishes. Traditionally we mostly collected relevant issues for our own project, but gradually we are moving to a more participatory approach where we consider our assets part of the system and also try to optimize our management from that perspective. This can however lead to challenges, as management gets more complex and sometimes more costly.
- On a scale from 1 (room for improvement) to 10 (superb), do you think your organization adheres to this principle? Why?

1 2 3 4 5 6 7 8 9 10

MANABAS Coast principle 2: "Integrate management of multiple assets and functions within the landscape system context"



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- Do you identify with this principle?

This feels like a logical consequence of principle 1. However, given the formal responsibilities of (individual) managing organizations this is not easy to establish. All organizations have formal, legal and budgetary restrictions for their management. I think that integrating management is not always necessary. By working from shared goals and visions, each managing organization can contribute from within their responsibilities.

- Are relevant organizations/institutions efficiently cooperating to jointly address system-wide challenges? If yes, which challenges and how?

A major challenge is making the coastal landscape more climate resilient. In our pilot case this consists of dealing with sea level rise and flood risk, good quality of nature / biodiversity and sustainable use of the hinterland. At the moment we mostly work from separate goals and visions. These visions are not always aligned when it comes to long term goals for the area. In our pilot case, developing joint goals for the coastal area (dike – salt marsh system) is one of the aims.

- If you see room for improvement in the integrated management of multiple landscape assets, what would be the necessary steps to take according to you? Briefly state

This is a very complex one. In the ideal world management would be integrated within one responsible body. But this is off course not possible/realistic. In our pilot, the first step is to consider development of integral management plans that are for instance already present in parts of Gernany (for salt marshes)

- On a scale from 1 (room for improvement) to 10 (superb) how much is this principle applicable to your organization?

1 2 3 4 5 6 7 8 9 10

### MANABAS Coast principle 3: “Embrace and leverage upon the natural dynamics of the system”

- Is this principle applicable to your situation/organization?

The Netherlands are a man-made country. Without (water)management our country would not exist. We see a tendency to work from the natural dynamics. The more concrete translation is that not everything is possible at every place because it would take too much effort to (contra)manage the natural development. However, it is impossible to fully embrace the natural system as this conflicts with human interest. This is also something we want to elaborate in our pilot. For instance, only consider development new salt marshes (or protecting salt marshes) if the morphological conditions are favorable both on the short and long term. If the BwN solution does not work on the long run in the natural system, consider applying a traditional solution that “defends” against.



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- What are the main natural processes that should be considered? Are these well-known with all the stakeholders?  
The most important processes in our case are the ecological and morphological developments in the foreshore of areas with dikes. Stakeholders are not always aware of the relatively large changes that occur in the system over time. They tend to look from the perspective of their own (sometimes lifelong!!) experiences. This is however not always sufficient. Because when we talk about sustainable solution for the long run (towards year 2100), the observed trends are not always representative for the future, especially not under a changing climate. Also, people tend to underestimate the influence our handling on both the ecological and morphological systems.
- How are using natural processes incorporated in the management practices within your organisation?  
We try to map the long term development of the natural processes in the Wadden Sea as good as possible. We try to understand how the area has developed and why. By sharing these information's and insight's with our surroundings and stakeholders, we hope to enable them to see which solutions are sustainable or not. Rijkswaterstaat plays a leading role in the Netherlands in developing and sharing system knowledge for the larger water systems, such as the Wadden Sea. The situation in the Netherlands is however complicated. As we almost never have "natural systems". The more practical question we therefore usually have to tackle is, how much interference/management do we allow in the natural system in order to preserve certain (human) interest.
- On a scale from 1 (room for improvement) to 10 (superb) how much is this principle applicable to your organization?

1 2 3 4 5 6 7 8 9 10

### Additional MANABAS Coast mainstreaming questions:

- In your view, what is essential in the mindset or way of working of people (policy makers, managers, professionals, general audience) to promote mainstreaming of NBS? Do stakeholders need more information on mainstreaming?  
I think it is very important to further elaborate and quantify the benefits of NbS. And make this as objective as possible. What I see is that NbS are almost automatically seen as a good solutions, whilst I think that traditional approaches may also serve for the goals. To give an example: consider you can built a tradional (dutch) dike with sand and asphalt. Or built a natural green dike of local clay. Some dilemma's: the green dike is usually considered as an improvement for

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ecology. However, a relatively small area is transferred from asphalt to grass. For the Wadden Sea ecosystem this is not always a significant improvement, whilst the green dike does require more space. This space is now often a salt marsh (or tidal flat), and building this type of dike leads to loss of some nature. The green dike is considered more sustainable by the use of local clay. However, the total volume of material being displaced is larger than for the traditional dike, which means more emissions to build it. And the clay needs to be taken from either nature or agricultural land. Besides that, asphalt is becoming more renewable too. So, how to decide which dike is really the best? And how to balance the different interests, also between social-economic and the natural system?

Maybe it is interesting to look at the SDG system to evaluate BwN solutions?

- What other leading principle(s) would you suggest?

I have no suggestion for the time being.

- How can we make these principles more applicable to the context of pilots?

Maybe we can develop a more concrete toolbox to apply to the pilots that maps too which extent the principles are met in the cases? And which dilemma's arise when applying the principles? For instance: is a sustainable solution for nature also sustainable for the people? And on which time and spatial scale? For instance, a reduction of greenhouse gasses is good for the global problem of climate change. However, when this requires a large effort on a local scale, how much "contribution" of the local population is reasonable?

- **Finally: What does mainstreaming mean for your pilot? Please briefly describe.**

Mainstreaming in our case does not mean that we aim to apply NbS as much as possible. We aim to facilitate the ongoing debate on how to integrate flood safety and nature improvements, focusing on the application of dikes and salt-marshes/foreshores. We want to provide guidance on which locations are suitable for this type of solution and why (and why not). For Rijkswaterstaat, being the project lead of this pilot, we also want to further elaborate and communicate the goals for salt marsh restoration and improvement with respect to their ecological values and under which conditions this can comply with the goals for flood safety.